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SAMUEL WILLIAM JOHNSON

IN the death of Samuel William Johnson the chemists of America have lost one more from that small band who, two generations ago, undertook to extend and develop the beginnings which had been made to establish laboratories for instruction in chemistry and to apply this science to the industries of the country. Among these men, most of whom have already passed away, few left a greater impress on American chemistry or American chemists than did Professor Johnson, for his whole life was devoted to training workers in his chosen field, to making others realize what chemistry could do for them and to developing institutions and methods to extend the knowledge of chemistry and make this available to those engaged in productive occupations. The principal field to which he devoted his efforts was the application of science to agriculture, the results of which efforts are far better appreciated today, when the practical returns are so apparent than they were during the years of his greatest activity when he was patiently struggling against the conservatism of the so-called practical men who were persuaded with difficulty to make the beginning which was essential to demonstrate the truth of what he was trying to teach them.

Professor Johnson was born July 3, 1830, in Kingsboro, Fulton County, New York. His parents were of Connecticut origin but were taken by their parents to New York state when children. Although his father spent most of his active life in successful business he early retired to a large and fertile farm, soon after 1830,

and on this farm Professor Johnson spent his boyhood. He thus early became familiar with practical agriculture.

His father's training and experience in business led him to take a keen interest in the problems presented to the farmer and his discussion of such questions awakened an interest in his son to know more of the principles upon which the processes depended which he daily saw in progress about him.

At the age of ten he entered the Lowville Academy where he remained seven years and there came under the influence and instruction of David Porter Mayhew, who was an enthusiastic student of the natural sciences. Mayhew had then recently secured the means of establishing a chemical laboratory and in this laboratory Professor Johnson obtained his first knowledge of chemistry and, as he once wrote, "there became fascinated with chemistry through the brilliantly illustrated lectures of the principal." Mayhew made him his assistant, and, in 1846, presented him with a then recently published translation of Fresenius's *Chemical Analysis*. The possession of this book led him to equip a laboratory at his own home in which he prepared most of the reagents described, and worked through the qualitative course.

In his first note-book, dated June, 1848, he described his laboratory as nearly completed and begins with an account of his first attempt to prepare distilled water. This book contains many interesting accounts of the difficulties he encountered in preparing his reagents, and gives an insight into the training he thus got at the beginning of his chemical career which left its marked impress on his habits of work and thought throughout the remainder of his life.

The ability to rely on his own resources

and to overcome difficulties by persistent effort soon developed a degree of self-confidence which enabled him to continue his studies in the face of difficulties which to most boys of his age would have seemed insurmountable. Although his father was interested in his chemical work he considered it an uncertain means for gaining a livelihood and opposed his son's determination to adopt it as his life work. He therefore undertook to show that he could support himself and so engaged in teaching in various schools at intervals for three years.

Having saved some money he entered the laboratory at Yale in 1850 and continued his studies with Benjamin Silliman and John P. Norton. His funds giving out, he again took up teaching and was so successful that his father became convinced that he had the capacity to take care of himself and decided to give him an opportunity to gain the education he had determined to secure.

After returning to Yale for another year he went abroad in 1853 and entered Erdmann's laboratory in June, where he stayed until the next April, studying various problems in organic and inorganic chemistry as well as attending lectures in other subjects. The next year he spent in Munich in the laboratory of Liebig and also studied with von Kobel and Pettenkofer. As a student at Munich he won the respect and friendship of Liebig, who followed with interest his later career and for several years after continued a correspondence with him. In 1855 he went to Paris, where he attended Chevreul's lectures. He spent the summer in England and worked for a short time with Frankland.

In September he returned to New Haven and took charge of the laboratory of the Yale Scientific School as chief assistant in

chemistry. The next year he was appointed to the new professorship of analytical chemistry. In 1857 he succeeded John A. Porter in the chair of agricultural chemistry and continued to give instruction in both these subjects until 1875, when he became professor of theoretical and agricultural chemistry. From 1870 until his retirement in 1895 he also gave instruction in organic chemistry.

Professor Johnson's agricultural work began while he was yet a student in his own laboratory in New York state. In 1847, when he was only seventeen years old, his first paper, "On fixing Ammonia," was published in the *Cultivator*. This was followed during the next few years by many other papers in this and other agricultural journals on various topics concerning the application of science to agriculture. After coming to Yale he continued his writings on agricultural science, and in 1856 read a paper to the Connecticut State Agricultural Society which led to his appointment as chemist to this society. In 1866 he became a member of the first Connecticut State Board of Agriculture and two years later its official chemist.

In 1873 he devoted his energies to the establishment of an agricultural experiment station in this state and spent much time visiting all parts of the state and arousing an interest in this subject. The work that he had done as chemist to the Agricultural Society and the State Board of Agriculture did much to make the advantages of such an institution evident to those engaged in farming. In 1877 an act was passed by the legislature establishing such an institution and he was appointed its director. The work that he had done for more than twenty years among the farmers of Connecticut had at last born fruit and the duty of organizing and de-

veloping the new institution occupied him, in addition to his college duties, during the twenty years succeeding.

Although the act incorporating the new station stated that its aim was "to promote agriculture by scientific investigation and experiment" his experience in bringing about its establishment showed him that it was necessary to devote a large part of his energies to work that would readily be recognized as of immediate pecuniary value to the farmer. Though his chief interest then, as always, lay in purely scientific research work on fundamental problems of agricultural science which he believed would be of greater value to agricultural practise, he felt it most important during the early years of the development of the institution to devote the larger part of its resources to such work as would win popular support for the institution. Most of his time, therefore, was given to establishing an effective fertilizer control and to improving the methods of practise on dairy farms and to perfecting the methods of agricultural analysis.

The limited resources of the station left little to be applied to the study of purely scientific problems, but such work as could be done along these lines was followed as far as possible, and to an increasing extent, as the resources of the station became larger. In his later years it was a constant source of regret that he was not able to take personal part in the research work which the federal funds now make possible in the institution he had founded. Many times he recalled to the writer the limited resources with which he had to work and expressed his regret that he had not been able to do the research work that he had for so long hoped to have the facilities to carry out.

By developing the details of station work and methods, by establishing high

standards of fair dealing both with the farmer and with those who supplied him, and by inspiring all who were associated with him with high ideals of scientific work he did more than any other man to make the experiment stations of the country the useful and successful institutions that they are. Those familiar with the details of his work can see the impress of what he did in countless ways in the methods now in use not only in the offices and laboratories of the other stations, but in many other laboratories devoted to other lines of work. His influence among those who have succeeded him in applying science to agriculture has been great, and he has had the pleasure of living to see others carrying out the plans which, in his youth, he hoped to carry out himself.

Professor Johnson achieved distinction not only as a teacher and as a promoter of agricultural science, but he won a high reputation among the legal profession by the great ability he showed as an expert in many important cases in court. The profound knowledge which he brought to bear on these cases, the great care and accuracy with which he performed the analytical work involved, the thoroughness with which he prepared every detail, and the clear and logical way in which he set forth his conclusions, have many times been recounted to the writer by leaders of the bar, and have always been accompanied with expressions of the highest admiration and respect for the ability he displayed.

Naturally of a retiring disposition and disinclined to acquire publicity by gaining positions of prominence in societies and public associations, he still took part with others in such organizations as he thought would contribute to the advancement of the sciences to which he was at heart devoted. Thus we find him at the age of twenty-one reading a paper before the American As-

sociation for the Advancement of Science of which he became a member at about this time. Later, in 1875, he was chairman of its sub-section of chemistry. In 1866 he was elected a member of the National Academy of Sciences and served on its committee on Sorghum sugar in 1881. He was long a member of the American Chemical Society and its president in 1878. He was one of the original members of the American Association of Official Agricultural Chemists and its president in 1888 and also president of the American Association of Agricultural Colleges and Experiment Stations in 1896.

Professor Johnson had a strong love of literature and was noted for his literary style and the simplicity and clearness with which he wrote. That this was a natural gift is evident from his paper "On the Houghite of Prof. Shepard," written when he was only twenty-one, in which he sets forth the results of his investigation with the skill of one who had had careful training and long experience in such work. His assured and finished style is shown in all his early contributions to the agricultural papers for which he wrote. That his most widely read book "How Crops Grow" was translated into nearly every civilized language was largely due to the purity and conciseness of the style in which it was written, for the character of this book was such that it would have been easy to rewrite the material into a new form and put it out as a new book.

While constantly occupied with scientific work Professor Johnson found time to keep himself informed of all that was new in nearly every branch of chemistry and agricultural science, and he also read much of general literature and of poetry, of which he had a high literary appreciation.

As a man Professor Johnson had a most

attractive personality which endeared him to all who were intimately associated with him. His kindly interest in his students and assistants and his many generous and helpful deeds in their behalf will long be remembered by those who had the good fortune to work with him.

THOMAS B. OSBORNE

THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE¹
ADDRESS OF THE PRESIDENT TO THE
PHYSIOLOGICAL SECTION

THE PHYSIOLOGICAL BASIS OF SUCCESS

DURING past years it has been customary for the presidents of sections in their addresses either to give a summary of recent investigations, in order to show the position and outlook of the branch of science appertaining to the section, or to utilize the opportunity for a connected account of researches in which they themselves have been engaged, and can therefore speak with the authority of personal experience as well as with that imparted by the presidential chair. The growing wealth of publications with the special function of giving summaries and surveys of the different branches of science, drawn up by men ranking as authorities in the subject of which they treat, renders such an interpretation of the presidential duties increasingly unnecessary, and the various journals which are open to every investigator make it difficult for me to give in an address anything which has not already seen the light in other forms. The association itself, however, has undergone a corresponding modification. Founded as a medium of communication between workers in different parts of the country, it has gradually acquired the not less important significance of a tribunal from which men of science, leaving for a time their laboratories, can speak to an audience of intelli-

gent laymen, including under this term all those who are engaged in the work of the world other than the advancement of science. These men would fain know the lessons that science has to teach in the living of the common life. By standing for a moment on the little pinnacle erected by the physicist, the chemist or the botanist, they can, or should be able to, gain new hints as to the conduct of the affairs of themselves, their town or their state. The enormous advance in the comfort and prosperity of our race during the last century has been due to the application of science, and this meeting of the association may be regarded as an annual mission in which an attempt is made to bring the latest results of scientific investigation into the daily routine of the life of the community.

We physiologists, as men who are laying the foundation on which medical knowledge must be built, have as our special preoccupation the study of man. Although every animal, and indeed every plant, comes within the sphere of our investigations, our main object is to obtain from such comparative study facts and principles which will enable us to elucidate the mechanism of man. In this task we view man, not as the psychologist or the historian does, by projecting into our object of study our own feelings and emotions, but by regarding him as a machine played upon by environmental events and reacting thereto in a way determined by its chemical and physical structure.

Can we not learn something of value in our common life by adopting this objective point of view and regarding man as the latest result of a continuous process of evolution which, begun in far-off ages, has formed, proved and rejected myriads of types before man himself appeared on the surface of the globe?

¹ Winnipeg, 1909.